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Semi-Annual Progress Report

on

An Analysis of Erythrocyte Metabolism

covering the period from 1 July 1952 to 1 February 1953

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From data previously reported, it was suggested that the low rate of oxygen consumption of human erythrocytes as compared to chicken, might be the result of low activity of some Krebs cycle enzymes. Before carrying these studies further, it was necessary to test the generalization that all nucleated erythrocytes have higher respiration than non-nucleated. It is difficult to make this comparison from the information available in the literature, because the measurements are at different temperatures. For these reasons, oxygen consumption of whole red blood cells in isotonic saline have been made at 20° and 37° C. wherever measures could be obtained at both temperatures. Some preliminary measures are given below:

	<u>Q O₂ at 20°</u>	<u>37° C.</u>
Human		0.03
Rabbit		0.04
Chicken	0.05	0.14
Frog	0.08	0.14
Fish	0.10	0.15
Sting Ray	0.15	0.27

It can be concluded that at 37° the nucleated erythrocytes respire at a higher rate than non-nucleated. The hypothesis is proposed that the level of activity of oxidases in the nucleated erythrocytes is higher than in the mammalian cells. The level of activity of glycolytic enzymes, however, should be similar since glycolysis is comparable. The enzyme assays previously reported uphold this hypothesis for chicken and human erythrocytes. This work has now been extended to a variety of other animals. The techniques have appeared in earlier reports. The Q O₂ values are given below:

	Succinoxidase	Malic oxidase	Malic dehydrogenase	Lactic dehydrogenase
Human	0.04±0.014	0.057±0.010	0.291±0.031	0.310±0.015
Rabbit	0.094	0.052	0.468	1.412
Chicken	0.534±0.031	0.544±0.028	0.709±0.032	0.534±0.035
Frog	0.119±0.051	0.104	0.370±0.043	0.440±0.100
Fish	0.033±0.019	0.294±0.020	0.770±0.063	0.441±0.046
Sting Ray	0.166±0.041	0.745±0.042	0.794±0.064	1.894±0.078

Where no standard error is given with the mean, this indicates that the data are only preliminary and may be revised with additional experiments. In general the hypothesis is still upheld. One can make a rough comparison of oxidase and dehydrogenase values of nucleated and non-nucleated cells by taking means from the above data. These are as follows:

	<u>Non-nucleated</u>	<u>Nucleated</u>
Oxidases	0.060	0.317
Dehydrogenases	0.620	0.744

Perhaps one of the most interesting observations one can make from a comparison of malic dehydrogenase and malic oxidase values above, is that cytochrome oxidase appears to be limiting in most of the erythrocytes studied.

Bibliography:

Baker, Alice S. and F. R. Hunter. 1953.
A comparative study of erythrocyte metabolism.
Fed. Proc. In press.